WMS Wound Care Practice Guidelines Summary
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Introduction

The skin is the largest organ in the body and accounts for a significant percentage of wilderness injuries. Even minor wounds can interfere with activities and be difficult to manage in the remote setting.

The goals of wound management in the field are to control hemorrhage, minimize risk of infection, promote optimal healing, minimize pain, limit disability and loss of function, provide definitive care when possible, and optimize cosmetic outcome.

Evaluation of Wounds in the Remote Setting

Evaluation of the wound begins with a careful history. The environment where the injury occurred, time since injury, patient history, and immunization status of the patient are important to guide management.

<u>Hemostasis</u>

Control of hemorrhage is important both for prevention of blood loss, as well as to allow examination of the wound. Direct pressure on the area of bleeding is the most effective way to control hemorrhage. Pressure dressings can maintain hemostasis but are less effective at gaining control of bleeding.

Hemostatic dressings are costly but may be useful when the wound is in a non-compressible area, or direct pressure is not controlling the bleeding. Impregnated gauze dressings are recommended over powder formulations. The hemostatic agent must be applied directly into the wound and used with direct pressure for a minimum of five minutes.

Tourniquets were controversial in the past due to the use of inadequate devices or from use by improperly trained individuals. Military experience has shown that tourniquets save lives when properly used. Tourniquets must be at least 4 cm. wide to obstruct arterial blood flow and contain a ratchet to achieve sufficient pressure. Tourniquets may be placed briefly to gain control of bleeding, and safely removed if hemorrhage is maintained with less aggressive measures within two hours after placement. After two hours, the tourniquet should not be released until the patient is at definitive care.

There is no evidence suggesting that limb elevation is effective in hemorrhage control, but it may be considered, as the risk to the patient is low. Use of pressure points is not recommended, as it is ineffective and might delay more appropriate therapy.

<u>Anesthesia</u>

Anesthesia is important for proper cleaning, thorough exploration, and possible closure of wounds. The most common means of providing anesthesia are intradermal or subcutaneous, but topical agents are useful for simple lacerations, and regional anesthetic nerve blocks may also be considered if the provider has appropriate training. Topical agents take 20-30 minutes to achieve maximal anesthesia. Pain from injected anesthetics is reduced by use of a smaller gauge needle and warming the solution before injection. Lidocaine can be buffered with sodium bicarbonate solution in a 9:1 ratio to further reduce discomfort. It was previously taught that use of anesthetic solutions with epinephrine should be avoided in anatomic locations with end-arteriole circulation such as fingers, nose and earlobes, but recent literature suggests use of commercially prepared anesthetics with epinephrine is safe and effective.

Wound Cleansing

Irrigation is effective in reducing bacterial load and removing foreign debris in wounds, and should be performed as soon as possible after injury. High-pressure irrigation is most effective and can be achieved in the field by using a 19-gauge catheter on a 35-ml. syringe. Lower pressure irrigation such as use of a bulb syringe or a pinhole in a bag of fluids is reasonable if supplies for high-pressure irrigation are not available. There is no difference between use of sterile solutions and tap water for irrigation. Irrigation fluid should be potable, with nothing added to the irrigation fluid unless the wound is rabies-prone. The ideal volume of irrigation is not known but likely depends on wound size and degree of contamination. Wounds that occur in the marine environment should be copiously irrigated due to the bacteria present in seawater.

Complications of foreign bodies depend on the size of the contaminant as well as the characteristics of the debris. Small foreign bodies such as glass and gravel are largely inert and are unlikely to impair healing. Organic material such as soil and clay can cause inflammation, and should be removed if it can be done safely. An attempt at removal of larger foreign bodies is prudent if the contaminant is organic material, if the foreign body is impinging on neurovascular structures, or if it is impairing function.

If removal of hair is required to facilitate wound care or closure, the hair should be clipped rather than shaved. Shaving damages the hair follicles and epithelium, increasing the risk of infection.

There is no evidence that use of clean technique reduces risk of infection compared to use of sterile technique. Wounds should be treated with clean gloves and instruments, but sterility is not required.

Immunizations

The tetanus immunization status of all patients with traumatic wounds should be assessed. If the patient has completed the primary series, the need for booster depends on time since last

immunization and the type of wound. Administration of penicillin is thought to reduce the risk of clinical disease in patients who are not adequately immunized.

Rabies can be transmitted by dog bites in the developing world and by the bites of bats, raccoons, skunks, and foxes in North America. In the wilderness setting, proper wound cleansing of a rabies-prone wound can reduce the risk of rabies until the patient can be evacuated for post-exposure prophylaxis. Povidone-iodine solution or chlorine dioxide are effective in killing the rabies virus. Rabies prone wounds should not be closed in the field.

Lacerations

Lacerations are common wilderness injuries. Timing of closure depends on degree of contamination, time since injury, and provider skill. Most clean wounds can be closed in the field within 4-6 hours of injury, and this can be extended to 10-12 hours for head and facial wounds. Grossly contaminated wounds should be cleansed and irrigated, then packed open to allow for delayed closure.

Surgical tape can be used for wounds that are not under tension, but tape has a higher risk of wound breakdown than with other types of wound closure. Tissue adhesive such as octyl cyanoacrylate can be used for smaller wounds that are not under tension. The use of tissue adhesive is quicker than suturing and less painful for the patient. The Hair Apposition Technique (or HAT) has been described for closure of scalp wounds: hair on either side of the wound is knotted or twisted and secured with tissue glue. HAT does not allow for approximation of the deeper layers of skin. None of these methods should be used if there is ongoing bleeding from the wound.

Sutures and staples help with hemostasis, and are equivalent in terms of wound healing and rates of infection. Staples are easier to use, but more bulky to carry in the field and result in a poorer cosmetic outcome. Most simple wounds in the wilderness can be treated with tissue adhesive, with sutures or staples being preferred for wounds with ongoing bleeding, or in areas of high tension. Facial wounds should be closed with tissue adhesive or fine gauge suture material.

A moist environment improves wound healing, although no specific types of dressings have been shown to be superior. In the field, a dressing will keep the wound moist and provide some protection from environmental contaminants.

Wound Infections

Oral antibiotics are advised for open fractures, human bites, and mammalian bites to the hand to prevent infection. Topical antibiotics are possibly useful, and there is little risk to their use assuming the patient is not allergic to the agent.

Approximately 1-12 percent of wounds become infected. If the wound was closed in the field, the wound should be reopened to allow any infected fluid to drain. Oral antibiotics should be initiated, with the best agent determined by the type of wound, patient allergies, and availability in the field. First generation cephalosporins are commonly used for skin and soft tissue infections, which are usually caused by gram-positive bacteria. Wound infections that occur in the marine environment are more likely to be caused by gram-negative bacteria, and fluoroquinolones or advanced generation cephalosporins are effective.

Evacuation

Factors suggesting need for early evacuation include animal bites with high risk of infection, need for tetanus or rabies immunization, anatomic location of wound in an important cosmetic location, associated nerve, tendon, or vascular injury, presence of foreign bodies, complex wounds that cannot be managed in the field, or an immunocompromised host. These patients are at increased risk of poor outcome and may require early evacuation. Patients who develop signs of wound infection after initial field treatment should be evacuated. Patients with significant burns to the face, hands, feet, or genitalia require early evacuation, as do patients with airway burns or respiratory compromise.